Electronic Services - Hayward, Ca
M17893X

Marka-Sweep 154-C Maintenance

KAY ELECTRIC CO.

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MAINTENANCE MANUAL
ISSUE C

AUGUST, 1967

MARKA-SWEEP 154C

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KAY ELECTRIC COMPANY
PINE BROOK, NEW JERSEY
227-2000

SECTION I
PRELIMINARY INFORMATION

1.1 INTRODUCTION

This manual presents all the necessary information for the maintenance and calibration of the Marka-Sweep 154-C sweeping oscillator. Also, a circuit description is included to simplify troubleshooting and repair. The specifications and operation procedures can be found in the Operator's Manual. Maintenance of the Marker Plug-in Heads is not covered in this book.

1.2 CIRCUIT DESCRIPTION

Board No. 9687

The sweep generator circuit develops a sawtooth signal which may be locked at line frequency or, by changing circuit constants and removing the line frequency sync signal, may be varied between .01 and 1,000 Hz. When the internal sweep generator is disabled, an external signal generator may be used to supply a CW signal for the sweep generator.

A pulse is taken from the emitter or collector of Q2, depending on sweep direction, and actuates switch Q-10 which drives Q-11. The blanking signal shorting diode D-1 of the 375-430 MHz oscillator. This turns off the swept RF output during the retrace time of the sawtooth signal, providing a zero voltage baseline when the output is displayed on an oscilloscope.

Board No. 9688

The sawtooth is then passed through the sweep linearity networks (collector circuits, Q-1 & Q-2) which shape the sawtooth signals to compensate for the non-linearities in the RF oscillators voltage/frequency curves. This shaped sawtooth signal is impressed across the voltage-variable capacitors in the tank circuits of the RF oscillators, changing the output frequency with respect to time.

Besides providing gain, Q-1 & Q-2 provide two sawtooth voltages, one being inverted from the other. The inversion causes one oscillator to sweep up in frequency while the other is sweeping down, each oscillator sweeping 55 MHz. Thus, the mixed output sweeps 110 MHz. This technique also minimizes output-vs-sweep voltage non-linearities.

The output of the two RF oscillators is mixed by diode D-3 and only the difference frequency is accepted by the filter composed of L-8, L-9, and C-21. Since the frequency range of the high-frequency oscillator is 375 to 430 MHz, and the frequency range of the low-frequency oscillator is 320 to 375 MHz, the output of the mixer will range between 0 and 110 MHz (Both oscillators start at 375 MHz output, then the frequency of the low-frequency oscillator decreases to 320 MHz, as the frequency of the high-frequency oscillator increases to 430 MHz).

The swept RF output is then passed through a high-frequency, wideband amplifier. Samples of the swept RF signal passing through this amplifier are taken for the ALC and marker circuits. The amplifier output is then passed through the attenuator to the RF OUT jack.

Board No. 9689

The portion of the swept RF signal sampled by diodes D-4 and D-5 generates an error voltage which is amplified by ALC amplifiers Q-3, Q-4, and Q-5. This signal is used to control a voltage-variable attenuator (D-2) through which the output of the high-frequency oscillator must pass before it is fed into the mixer circuit. The ALC circuits function to keep the sweep output constant throughout the range of the instrument.

In order to obtain the detected envelope of a response curve, the output of the device under test may be patched into the DETECTOR jack (provided the output impedance of the device matches the input of the DETECTOR: 50 or 75 ohms). The RF signal is detected by the voltage-doubler diode detector circuit (D-8 and D-9) and the response envelope is made available at the VERT jack.

Board No. 9686

Birdie markers are developed in the 154-C when a CW signal, within the range of the instrument, is fed into the MARKER INPUT jacks. The CW signal, and a portion of the swept RF signal, are fed into diodes D-6 & D-7, where they are mixed. When the two input signals approach the same frequency, an audio beat note is produced. This note is amplified by the birdie marker amplifier and made available at the VERT jack.

The third portion of the swept RF output is fed to Q-8, a buffer amplifier and then to the marker circuits contained in the plug-in head. The buffer amplifier serves to isolate the RF circuits from the marker circuits.

SECTION II
ALIGNMENT PROCEDURE

2.1 INTRODUCTION

This section provides the operator with information necessary to perform a complete factory-type alignment of the instrument. If any trouble is experienced in meeting the specifications called for, consult the trouble shooting section for possible malfunctions. The accuracy of alignments will be maintained by allowing a reasonable warm-up period.

2.2 FUNCTION OF INTERNAL CONTROLS

CONTROL	COMPONENT	FUNCTION
P/C/B 9685 +62 volt adj. +30 volt adj. -30 volt adj.	 R-13 R-23 R-36	Set the proper power supply voltages.
P/C/B 9687 Zero symmetry Adj.	 R-14	Adjusts sweep waveform for symmetry about zero volts.
Sweep Ratio Adj.	R-24	Adjusts triangular waveform rise/fall time ratio.
P/C/B 9688 Sweep Width "L"	 R-1	Adjusts for full 0-110 MHz sweep.
Sweep Balance "A"	R-26	Calibration of Center Frequency Dial.
High Frequency Adj. "J"	R-30	Calibration of Center Frequency Dial.
Center Frequency Adj. "K"	R-21	Calibration of Center Frequency Dial.
Sweep Linearity "B thru I"		Adjusts frequency calibration.
P/C/B 9689 Ext ALC Offset	 R-6	Compensates for variations in EXT ALC DETECTORS - Sets ALC within operating range.
Meter Adj.	R-16	Adjusts for 1.0V reading on meter with 1.0V at RF OUT jack.

2.3 ALIGNMENT PROCEDURE

Equipment Required:

Oscilloscope, Tektronix 503 or equiv.
Oscilloscope, Tektronix 561 w/type 2A63 and 2B67 plug-in heads
(2) 1-50 MHz RF Generator
Audio Oscillator, Donner Model 1202 or equiv.
VTVM
UHF Grid Dip Meter
RF Power Meter
Absorption - Type wavetraps - 50 KHz, 200 KHz, & 1 MHz
Variable Autotransformer - 105 to 128 volts AC
0-30 volt DC supply
Calibrated Detector - 50 KHz to 100 MHz
Grid Dip Meter

A. POWER SUPPLY - P/C/B #9685

1. The +62 volt supply feeds the regulation circuits and should be adjusted first.

2. Using a VTVM on pin H of PJ-9, set R-13 for +62 volts.

3. Set R-23 for +30 volts on pin R of PJ-9.

4. Set R-36 for -30 volts on pin C of PJ-9.

5. Using an autotransformer, vary the line voltage between 105 and 128 volts. The +62 volts supply should vary no more than 12 MV, the +30 volt supply should vary no more than 15 Mv, and the -30 volt supply should vary no more than 95 Mv.

6. To check the AC ripple content of the power supplies, set up the 154-C as follows:

   a. FUNCTION selector to CW.
   b. CENTER FREQUENCY to 50 MHz.
   c. MARKER LEVEL and GAIN controls fully CCW.
   d. Remove marker plug-in.
   e. Switch in 40 db of attenuation.

   Use a non-attenuating shielded scope probe and check for the following:

   a. Pin "H" P/C/B #9685 - 0.5 Mv p/p
   b. Pin "R" P/C/B #9685 - 1.2 Mv p/p
   c. Pin "C" P/C/B #9685 - 0.5 Mv p/p

B. SWEEP VOLTAGE GENERATOR - P/C/B #9687

1. Connect HORIZ jack to vertical input of oscilloscope. Set scope to internal sweep.

2. Set 154-C FUNCTION SELECTOR to VAR SWP, sweep rate to 100 Hz, and set ZERO SYMMETRY ADJ (R-14) and SWEEP RATIO ADJ (R-24) to MIDRANGE.

3. Set SWEEP RATIO ADJ (on rear panel) to MIDRANGE.

4. Center sweep on horizontal axis of scope.

5. Adjust ZERO SYMMETRY for a symmetrical waveform. Peak to peak voltage should be approximately 9 V.

6. Set SWEEP RATIO ADJ (R-74, main chassis) maximum clockwise, scope time base to 1 MS/CM, 154-C FUNCTION SELECTOR to VAR, and SWEEP SELECTOR to the 100 - 1000 Hz range.

7. Adjust SWEEP RATIO ADJ (R-24 P/C/B #9687) for a rise time of 0.4 Ms and a fall time of 5 Ms. Sweep rate (VARIABLE) may be adjusted if necessary to obtain this waveform.

8. Adjust SWEEP RATIO ADJ (R-74, main chassis) counterclockwise for same inverse ratio as in step 7. Reset for symmetrical sweep.

9. Check sweep rate positions to see that they correspond with Fig. There are no adjustments for these ranges; they are controlled by fixed, tuned circuits.

10. Set FUNCTION SELECTOR and SWEEP RATE to LINE LOCK position.

11. Adjust LINE LOCK ADJ (R-76, main chassis) until sweep locks to line frequency.

C. SWEEPING OSCILLATOR CIRCUITS

1. Set all controls on SWEEP and LINEARITY board (P/C/B #9688) to MIDRANGE.

2. Set FUNCTION SELECTOR to CW.

3. Connect VTVM across C-9 of 375-430 MHz oscillator and tune CENTER FREQ. dial for 5 volts. ZERO ADJUST (front panel) may be adjusted to obtain this reading.

4. Remove the ALC board from its connector.

5. Probe the oscillator with Grid Dip Meter and adjust L-2 for a peak reading at 375 MHz. The windings of L-2 may be spread or compressed to set this frequency.

6. Reinstall the ALC Board in its proper position.

7. Connect the VTVM across C-15 of the 325-375 MHz oscillator and tune the CENTER FREQUENCY dial for 5V. The ZERO ADJUST may be adjusted to obtain this reading.

8. Using the Grid Dip Meter, tune L-6 for a peak reading at 325 MHz. The coil windings may be spread or compressed to obtain this reading.

D. RF MIXER BIAS

1. Set FUNCTION Selector to CW and switch in 40 DB of attenuation.

2. Tune the CENTER FREQUENCY dial for 15V on C-15 in the 325-375 MHz oscillator.

3. Check for 0.12V to 0.15V across R-20 in the RF amplifier. Capacitor C-19 may be selected between 0.1 and 0.18 pfd to obtain this voltage.

E. RF AMPLIFIER

1. Interconnect equipment as in Fig. 3.1 .

2. Set FUNCTION selector to VAR, SWEEP WIDTH to MAXIMUM, SWEEP WIDTH switch to X1, CENTER FREQUENCY dial to 50 MHz, rear apron MARKERS to EXT, SWEEP RANGE 10-100 Hz, SWEEP RATE VARIABLE midrange, rear apron SWEEP to L to H, rear apron ALC to INTERNAL, and BLANKING - ON.

3. Set scope HORIZ for external sweep and vertical gain to 0.5V/cm.

4. Provide markers and adjust MARKER LEVEL controls for useable amplitude. Adjust CENTER FREQUENCY dial for a sweep 0 to maximum sweep width.

5. Turn RF LEVEL control maximum clockwise. Adjust RF LEVEL (Internal) for a 4 cm detected output.

6. Switch FUNCTION selector to MAN and use the MANUAL SWEEP control to adjust the output to approximately 50 MHz.

7. Switch in 6 DB of attenuation.

8. Connect Power Meter to RF OUT jack and adjust RF LEVEL (Internal) for a 5 MW reading.

9. Remove the Power Meter and the 6 DB of attenuation.

10. Switch FUNCTION SELECTOR to VAR and reconnect cable from RF OUTPUT to DETECTOR.

11. Note ALC'd Level and record for further use.

12. Set METER ADJ for 1 VRMS on front panel meter.

13. Coil L-7 in the RF Amplifier may be tuned for MAXIMUM ALC action at high frequency.

14. Adjust the internal RF LEVEL control so that the RF output is increased and the ALC no longer has any effect. There should be at least 1 cm of output over that noted in step 11 between 50 and 110 MHz. If this level can not be obtained L-7 may be returned and R-10 in the voltage variable attenuator increased to 33Ω.

15. Reset RF LEVEL control for 1 VRMS. Add 6 DB of attenuation and note the level. Switch out the attenuation and turn down both RF LEVEL controls until the output equals that of the 6 DB level.

16. Reset 1 VRMS level. Turn FUNCTION selector to LINE LOCK and set rear panel SWEEP switch to H-L. The sweep should be flat across the whole width of the sweep.

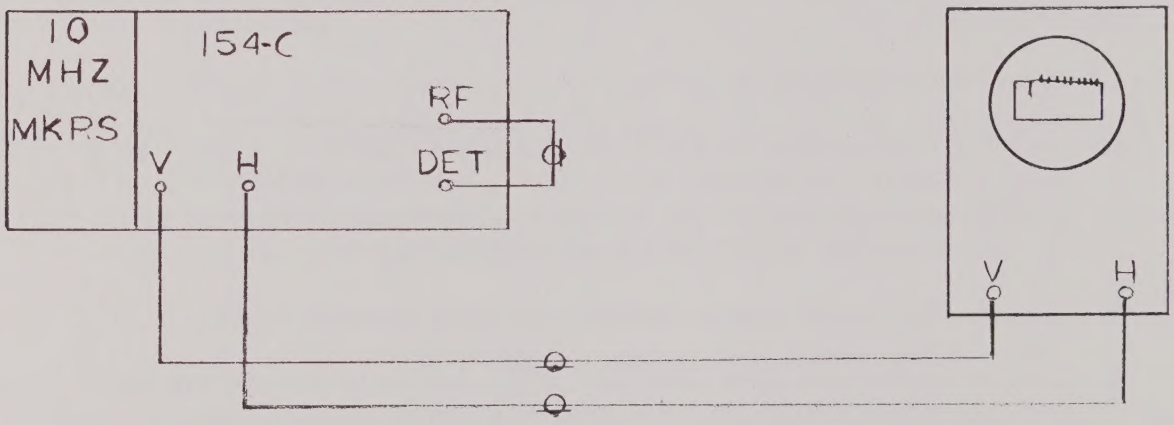


FIG. 3.1 RF AMPLIFIER ALIGNMENT

F. LINEARITY AND DIAL CALIBRATION

1. Set the controls on board 9688 as follows:

   SWEEP WIDTH (L) - MIDRANGE
   HIGH FREQ ADJ (J) - MIDRANGE
   CENTER FREQ ADJ (K) - MIDRANGE
   SWEEP BAL (A) - MIDRANGE
   LINEARITY ADJ (F, H, B, D) - counterclockwise
   LINEARITY ADJ (G, I, C, E) - clockwise

2. Place FUNCTION selector to CW position, turn CENTER FREQUENCY dial until zero volts is read at pin "U" of board 9688. (Use Low VTVM Range 3V or lower, full scale).

3. Using the SWEEP BAL control, adjust for a median voltage of 26 volts on feed thru C-9 and C-15 (high and low frequency oscillators).

4. Remove the horizontal input to the scope and center the trace. Reconnect the horizontal and disconnect the vertical input. Using the ZERO SYMMETRY ADJ (R-14, board 9687), center the trace again. Reconnect the vertical input.

5. Provide 10 MHz markers and use the CENTER FREQUENCY dial to exactly center the 50 MHz marker.

6. Turn SWEEP WIDTH control (front panel) almost maximum CCW, SWEEP WIDTH switch X. 1, slightly adjust the CENTER FREQUENCY control to center the marker on the scope.

7. Set SWEEP WIDTH control maximum CW and see that the 50 MHz marker falls within ±1/10 cm of the vertical axis. If the marker is off-center it may be positioned by selecting R-3 and returned to +30 volts or -30 volts.

8. Position, by means of the SWEEP WIDTH (front panel) and CENTER FREQUENCY controls, the 40, 50, and 60 MHz markers behind the middle three verticals (within ±. 05 cm) of the scope graticule.

9. LINEARITY ADJUSTMENT CHART

Sequence of Adjustment	Controls		Markers Affected
	Threshold	Magnitude	
1	B(R-9)	C(R-11)	70
2		C(R-11)	80
3	D(R-8)	E(R-12)	90
4		E(R-12)	100
5	F(R-18)	G(R-15)	30
6		G(R-15)	20
7	H(R-19)	I(R-16)	10
8		I(R-16)	0

10. All markers are adjusted in the same manner, so one example will be examined.

    a. Use the threshold control "B" to position the 70 MHz marker slightly to the 60 MHz side of the vertical. Now adjust control "C" to bring the marker exactly on the vertical. This procedure may have to be repeated due to the interaction of controls. For exact alignment, the 80 MHz marker must fall on its proper vertical.

11. Continue the alignment, following the LINEARITY ADJUSTMENT CHART. (All markers to be within ±. 05 cm of verticals).

12. Set the CENTER FREQUENCY dial to zero and the SWEEP WIDTH control maximum CCW. Use the ZERO ADJ control to center the zero beat on the oscilloscope screen.

13. Turn the CENTER FREQUENCY control to 100 MHz. Use the HIGH FREQUENCY ADJ ("J" P/C/B 9688) to center the 100 MHz marker.

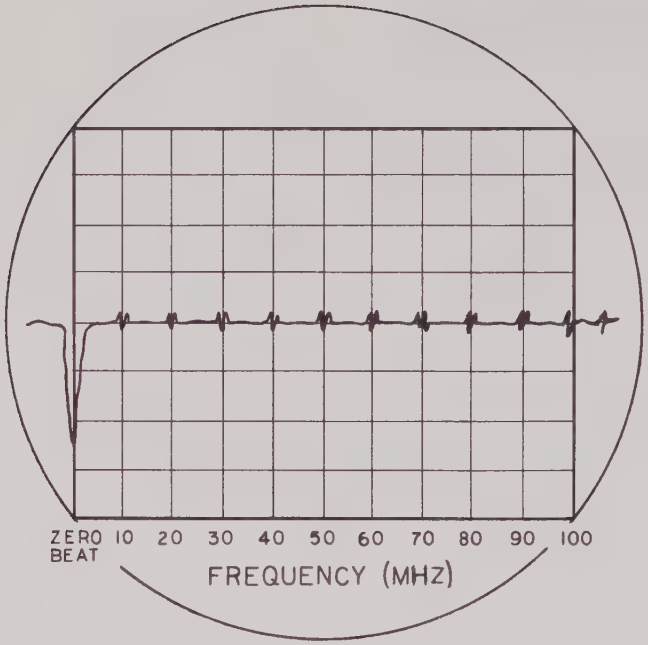


FIG. 3.2 POSITION OF MARKERS

14. Repeat the two preceeding steps until no further adjustment is necessary.

15. Center the 50 MHz marker on the scope. The CENTER FREQUENCY dial should read 50 MHz ±200 KHz. CENTER FREQUENCY ADJ ("K") may be used to center the marker.

16. Repeat steps 13 & 14 until the specification of (15) is obtained.

G. SWEEP WIDTH

1. Set the SWEEP WIDTH control to maximum CW and see that the 0-110 MHz sweep comprises about 75% of the total sweep.

2. The SWEEP WIDTH control ("L" P/C/B #9688) may be used to provide the 75% sweep.

H. EXTERNAL MODULATION

1. Connect equipment as shown in Fig. 3.3.

2. Set controls as follows:

   FUNCTION SELECTOR - EXT
   SWEEP WIDTH - Fully CW
   SWEEP WIDTH switch - X1
   CENTER FREQ - 50 MHz

3. Set Audio Generator to 60 Hz with ±1.25Vp output.

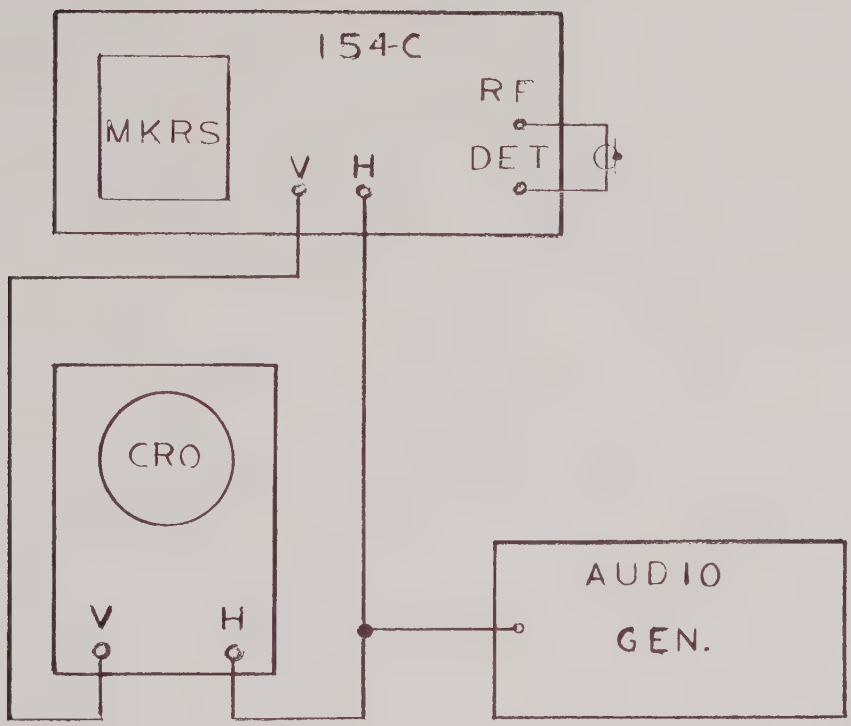


FIG. 3.3 EXTERNAL MODULATION CHECK

4. See that the zero beat and the 110 MHz marker are visible on the oscilloscope.

5. Repeat steps 3 & 4 with the Audio Generator at 400 Hz and note that full sweep width is available.

SECTION III
MAINTENANCE

3.1 VISUAL INSPECTION

The 154-C should be checked periodically, usually during alignment or inspection periods, for such things as loose or broken connections, loose jacks and connectors, or faulty printed circuit boards. Signs of overheating may indicate less apparent troubles.

3.2 PARTS REPLACEMENT

Most components used in this instrument are easily accessible and require no special replacement techniques. Some components, such as the solid-state devices, may be damaged by intense heat and special care should be exercised when soldering. Longnose pliers may be used as a heat sink between the component and the tip of the soldering iron. To avoid damaging semiconductor devices with low voltage ratings, the tip of the soldering iron should be at an electrical ground potential.

The oscillator and amplifier sections are highly critical. To maintain proper operation of these circuits, it is important that components be replaced in their original positions and that the lead lengths remain the same.

3.3 TROUBLESHOOTING DATA

This section contains information which will be useful when servicing the 154-C. To minimize unnecessary labor, try to use the Alignment Procedure before making any repairs. Certain abnormalities may be compensated for by using the proper adjustments.

NO SIGNAL AT ANY OUTPUT

Check fuse F-1, the line cord and the power switch for continuity. If these are good, check the primary windings of transformer T-1.

If the previous checks prove acceptable, measure the output of each power supply. If all the voltages are abnormal, investigate the +62 volt supply and then the +30 and -30 volt supplies. The power supply voltage chart may be used to check these circuits. The voltage readings are approximate and will vary according to the AC line voltage and the settings of the power supply potentiometers.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+62V	+63V	+90V*
Q2	+47V	+47.7V	+63V
Q3	+62V	+62V	+63V
Q4	+8.4V	+9V	+49V
Q5	+8.4V	+9V	+54V
Q6	+30V	+30.5V	+41.5V*
Q7	-30V	+30V	+30.5V
Q8	+6.8V	+7.4V	+30.5V
Q9	-30V	-30.5V	-43V*
Q10	-30.5V	-31V	-43V
Q11	-30V	-30V	-31V
Q12	0V	-0.6V	-31V

*AC LINE AT 117V

POWER SUPPLY VOLTAGE CHART P/C/B #9685

IMPROPER HORIZ OUTPUT

Check the SWEEP VOLTAGE GENERATOR, board #9687. Refer to the schematic and the voltage chart for proper waveforms.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	-8.5V -23V	-7V -20V -26V	
Q2	Same as Q1 E		0 - 8.6V
Q3	-4.4V (.070V p/p)	-3.8V (.075V p/p)	
Q4	-3.8V (.070V p/p)	Same as Q3 E	
Q5	-3.2V (.050V p/p)	Same as Q4 E	-6.5V -18.5V
Q6	Same as Q5 E	-3,8V (.030V p/p)	-11V -18V
Q7	-7V -19V	Same as Q5 C	-0.3V -1.2V
Q8	+5.5V -5.5V		+27.5V +12V
Q9	0	+9V -0.2V	0V -30V
Q10	0	Swp L-H +1V -0.2V Swp H-L 0 -0.2V	
Q11	Swp L-H 0V -20V Swp H-L 0 -20V		

(1) Conditions of Measurement

a. FUNCTION & SWEEP RATE - LINE LOCK

SWEEP VOLTAGE GENERATOR P/C/B #9687

IMPROPER VERT OUTPUT; RF OUTPUT IS NORMAL

Check the diodes in the RF detector circuits.

LINE LOCK INOPERATIVE

If all other indications are normal, check the 6.3 volt AC winding of T-1.

If the 6.3 volt AC signal is present at pin "F" of board 9687, the LINE-SYNC switch circuit should be examined. The voltage chart gives approximate values for each transistor.

LOW RF OUTPUT

When the RF output is low, check the RF amplifier and RF oscillator circuits. The ALC may also be checked. Refer to the voltage chart for approximate D.C. voltage levels.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	-3.7V	-3.9V	-20V
Q2	-3.7V	-3.9V	-20V

R.F. OSC.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q3	+23V	+23.6V	+28V
Q4	+23V	+23.6V	+28V
Q5	+11V	+11.6V	+25V
Q6	+5.8V	+6.4V	+18V
Q7	+14V	+14.6V	+26.5V
Q8	+18.5V	+19.2V	+28.5V

R.F. AMPLIFIER

EXCESSIVE HARMONIC DISTORTIONS

R-10 in VOLTAGE VARIABLE ATTENUATOR may be selected. (22-33Ω)

R-32 in RF AMPLIFIER may be selected. (33-68Ω)

Adjust L-7 for best improvement.

After any of the above steps check for proper RF output and re-adjust if necessary.

NO BASELINE

Check the BLANKING AMPLIFIER circuitry. Switch to LINE LOCK and refer to the voltage chart.

INSUFFICIENT SWEEP WIDTH IN:

LINE LOCK & VAR SWEEP

If the unit operates correctly in MAN, but will not sweep the full range in these functions check first for a sawtooth of approximately 10V peak-to-peak at the HORIZ jack. If this can not be obtained, SWEEP WIDTH pot R-1 on the Sweep Amplifier and Linearity board may be adjusted, then examine the entire Sweep Voltage Generator.

MAN SWP

Check R-73 (Front Panel Control), R-3 and R-4 on P/C/B #9688. Check continuity thru FUNCTION SELECTOR switch (S-1).

SWEEP NOT LINEAR

Check for continuity thru linearity networks. Check to see that linearity adjustment is correct.

IMPROPER RF OUTPUT

If the amplifier response is not flat, check the ALC amplifiers and detectors. The diode in the RF Voltage Variable Attenuator may also be checked.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1 (1)	-1.3V		+27V
Q2 (1)	+2.2V -0.24V	+1.5V -0.9V	 -27V
Q3 (2)	+1.8V +1.0V	+2.4V +1.6V	+6.8V +9.4V
Q4 (2)	+1.8V +1.0V	+2.4V +1.4V	+10.1V +10.0V
Q5 (2)	+9.5V +9.4V	+10.1V +10.0V	+18.5V +18.0V

(1) Conditions of Measurement
- a. No Input Signal to EXT ALC INPUT (Rear).
- b. S-1 on Internal.
- c. Upper Voltage - R6 Minimum.
- d. Lower Voltage - R6 Maximum.

(2) Conditions of Measurement
- a. ALC - INT
- b. CENTER FREQ - 50 MHz
- c. FUNCTION - CW

ALC P/C/B #9689

3.4 RESHIPMENT INSTRUCTIONS

When returning equipment for any reason, it is necessary to secure permission from the factory or an accredited Kay representative before doing so.

To protect the Marka-Sweep during transit, please see that the instrument is securely wrapped and padded. A packing slip listing the shippers identification, instrument type and serial number, and a statement indicating the malfunction will be helpful to the factory service personnel.

3.5 PARTS LIST

To insure satisfactory performance, use only exact replacement parts when making repairs. These are available from the Kay Electric Company. When ordering parts, please make reference to the instrument type, serial number, circuit symbol number and the Kay part number.

PARTS LIST, BIRDIE MARKER AMPLIFIER

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
	Entire Birdie Marker Amplifier	9686	
CAPACITORS:			
C1	.005μf, 100V, Mylar-Paper	6899-14	Elmenco 1DP-1-502
C2 & C3	0.1μf, 100V, Mylar-Paper	6899-11	Elmenco 1DP-2-104
C4 & C5	.005μf, 100V, Mylar-Paper	6899-14	Elmenco 1DP-1-502
C6	0.1μf, 100V, Mylar-Paper	6899-11	Elmenco 1DP-2-104
C7	.005μf, 100V, Mylar-Paper	6899-14	Elmenco 1DP-1-502
C8	50pf, 500V, Silver Mica	6359-60	Elmenco D15-500
C9	.05μf, 100V, Mylar-Paper	6899-1	Elmenco 1DP-2-503
C10	.002μf, 600V, Mylar-Paper	6899-4	Elmenco 6DP-1-202
C11	250μf, 500V, Silver Mica	6359-75	Elmenco DM-15-251
C12	2.2μf, 50V, Electrolytic	6355-128	G.E. 76F02LC2R2
DIODES:			
D1 & D2	1N461, Silicon	6357-57	Texas 1N461
TRANSISTORS:			
Q1 thru Q3	Transistor, 2N3565	K173	Fairchild 2N3565
Q4	Transistor, 2N2270	K132	RCA 2N2270
RESISTORS: (Unless other wise specified, all components are fixed composition, ½watt, 10% tol.)			
R1	1K	1021-E	Allen Bradley EB1021
R2	150K	1541-E	Allen Bradley EB1541
R3	68K, 5% tol.	6835-E	Allen Bradley EB6835
R4	33K	3331-E	Allen Bradley EB3331
R5	100K	1041-E	Allen Bradley EB1041
R6	100	1011-E	Allen Bradley EB1011
R7	47K	4731-E	Allen Bradley EB4731
R8	270K	2741-E	Allen Bradley EB2741-E
R9	10K	1031-E	Allen Bradley EB1031

R10	100Ω	1011-E	Allen Bradley EB1011
R11	2.2K	2221-E	Allen Bradley EB2221
R12	22K	2231-E	Allen Bradley EB2231
R13	120K, 5% tol.	1245-E	Allen Bradley EB1245
R14	620Ω, 5% tol.	6215-E	Allen Bradley EB6215
R15	2.7K	2721-E	Allen Bradley EB2721
R16	100K	1041-E	Allen Bradley EB1041
R17	68K, 5% tol.	6835-E	Allen Bradley EB1245
R18	33K	3331-E	Allen Bradley EB3331
R19	30K, 5% tol.	3035-E	Allen Bradley EB3035
R20	62K, 5% tol.	6235-E	Allen Bradley EB6235
R21	15K	1531-E	Allen Bradley EB1531
R22 & R23	47K	4731-E	Allen Bradley EB4731
R24	12K	1231-E	Allen Bradley EB1231
R25	2K, 5% tol.	2025-E	Allen Bradley EB2025

PARTS LIST, POWER SUPPLY

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
CAPACITORS:			
C1	1μf, 200V, Mylar	6411-21	Electro Cube
C2	.01μf, 100V, Mylar-Paper	6899-12	Elmenco 1DP-1-103
C3	10μf, 25V, Electrolytic	6355-94	Sprague 40D106C625DB3
C4	.25μf, 100V, Mylar-Paper	6899-20	Elmenco 1DP-3-254
C5	2.2μf, 50V, Electrolytic	6355-128	G.E. 76F02LC2R2
C6	33μf, 50V, Electrolytic	6355-132	G.E. 76F02LL339
C7	33μf, 50V, Electrolytic	6355-132	G.E. 76F02LL339
C8	.05μf, 100V, Mylar-Paper	6899-1	Elmenco 1DP-2-503
C9	2.2μf, 50V, Electrolytic	6355-128	G.E. 76F02LC2R2
C10	33μf, 50V, Electrolytic	6355-132	G.E. 76F02LL339
C11	18μf, 100V, Electrolytic	6355-73	Sprague Type 40D
DIODES:			
D1	Silicon Rectifier F6	6357-3	Sarkes Tarzian F6
D2	Silicon Rectifier F6	6357-3	Sarkes Tarzian F6
D3	Silicon 1N461	6357-57	Texas 1N461
D4	1N4756, Zener	6357-100	Motorola 1N4756
D5	1N936TC, Zener	6357-106	Motorola 1N936TC
D6 thru D9	Silicon Rectifier F6	6357-3	Sarkes Tarzian F6
D10	Silicon 1N461	6357-57	Texas 1N461
D11	1N4736, Zener	6357-98	Motorola 1N4736
D12	Silicon 1N461	6357-57	Texas 1N461
TRANSISTORS:			
Q1	40322	K-191	RCA 40322

Q2	2N3566	K-159	Fairchild 2N3566
Q3	2N3566	K-159	Fairchild 2N3566
Q4	2N3569	K-179	Fairchild 2N3569
Q5	2N3569	K-179	Fairchild 2N3569
Q6	40250	K-160	RCA 40250
Q7	2N3566	K-159	Fairchild 2N3566
Q8	2N2270	K-132	RCA 2N2270
Q9	2N3740	K-190	Motorola 2N3740
Q10 thru Q12	2N3645	K-189	Fairchild 2N3645

RESISTORS: (Unless indicated all resistances are in ohms, $\frac{1}{2}$ watt, 10% tol.

R1	91K, 5% tol.	9135-E	Allen Bradley EB9135
R2	91K, 5% tol.	9135-E	Allen Bradley EB9135
R3	12K	1231-E	Allen Bradley EB1231
R4	250Ω, 5 watt	2511-J	Ward Leonard 5XM250
R5	7.5Ω, 5% tol.	7P55-E	Allen Bradley EB7G55
R6	470Ω	4711-E	Allen Bradley EB4711
R7	2.2K	2221-E	Allen Bradley EB2221
R8	4.7K	4721-E	Allen Bradley EB4721
R9	10K	1031-E	Allen Bradley EB1031
R10	3.9K	3921-E	Allen Bradley EB3921
R11	10K	1031-E	Allen Bradley EB1031
R12	27K, 5% tol.	9292-15	Corning Type C5
R13	1K, 2K, 5K, pot, Var.	9167-1	Kay Electric Co.
R14	4.3K, 5% tol.	9292-12	Corning Type C5
R15	33K, 5% tol.	3335-E	Allen Bradley EB3335
R16	39K, 5% tol.	3935-E	Allen Bradley EB3935
R17	2.2Ω, 1 watt, 5% tol.	9292-18	IRC Type BWH
R18	470Ω	4711-E	Allen Bradley EB4711
R19	3.9K	3921-E	Allen Bradley EB3921
R20	3.3K	3321-E	Allen Bradley EB3321
R21	330Ω	3311-E	Allen Bradley EB3311
R22	7.5, 5% tol.	9292-16	Corning Type C5
R23	1K, 2K, 5K, pot, Var.	9167-1	Kay Electric Co.
R24	2.4K, 5% tol.	9292-11	Corning Type C5
R25	4.7Ω, 1 watt, 5% tol.	9292-19	IRC Type BWH
R26	2.2K	2221-E	Allen Bradley EB2221
R27	100Ω	1011-E	Allen Bradley EB1011
R28	4.7K	4721-E	Allen Bradley EB4721
R29	36K, 5% tol.	3635-E	Allen Bradley EB3635
R30	39K, 5% tol.	3935-E	Allen Bradley EB3935
R31	8.2K	8221-E	Allen Bradley EB8221
R32	470Ω	4711-E	Allen Bradley EB4711
R33	2Ω, 1 watt, 5% tol.	9292-20	IRC Type BWH
R34	330Ω	3311-E	Allen Bradley EB3311
R35	5.6K, 5% tol.	9292-13	Corning Type C5
R36	See R13	-------	----------
R37	330Ω	3311-E	Allen Bradley EB3311
R38	10Ω, 5 watt, w/w	9292-21	Ward Leonard 5XM10
R39	12K, 5% tol.	9292-15	Corning Type C5

PARTS LIST, SWEEP VOLTAGE GENERATOR

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
CAPACITORS:			
C1	.01μf, 100V, Mylar-Paper	6899-12	Elmenco 1DP-1-103
C2	.001μf, 600V, Mylar-Paper	6899-10	Elmenco 6DP-1-102
DIODES:			
D1 & D2	1N4742, Zener	6357-107	Motorola 1N4742
TRANSISTORS:			
Q1 & Q2	2N1308	K-133	Texas 2N1308
Q3	SE4002	K-192	Fairchild SE4002
Q4	2N3645	K-189	Fairchild 2N3645
Q5 & Q6	2N3638A	K-178	Fairchild 2N3638A
Q7	2N3566	K-159	Fairchild 2N3566
Q8	2N3568	K-187	Fairchild 2N3568
Q9	2N1377	K-134	Texas 2N1377
Q10	2N3638A	K-178	Fairchild 2N3638A
Q11	2N3645	K-189	Fairchild 2N3645
RESISTORS: (Unless indicated all components are fixed composition, $\frac{1}{2}$ watt, 10% tol.)			
R1	3.3K	3321-E	Allen Bradley EB3321
R2	1K	1021-E	Allen Bradley EB1021
R3	18K	1831-E	Allen Bradley EB1831
R4	470	4711-E	Allen Bradley EB4711
R5	62K, 5% tol.	6235-E	Allen Bradley EB6235
R6	100	1011-E	Allen Bradley EB1011
R7	470K	4741-E	Allen Bradley EB4741
R8	100	1011-E	Allen Bradley EB1011
R9	6.8K	6821-E	Allen Bradley EB6821
R10	8.2K	8221-E	Allen Bradley EB8221
R11	15K	1531-E	Allen Bradley EB1531
R12	5.6K	5621-E	Allen Bradley EB5621
R13	100	1011-E	Allen Bradley EB1011
R14	2K, 25K, pot, Var.	9718-1	Kay Electric Co.
R15	8.2K	8221-E	Allen Bradley EB8221
R16	1.8K	1821-E	Allen Bradley EB1821
R17	820	8211-E	Allen Bradley EB8211
R18	220	2211-E	Allen Bradley EB2211
R19	5.6K	5621-E	Allen Bradley EB5621
R20	1.2K	1221-E	Allen Bradley EB1221

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
R21	3.3K	3321-E	Allen Bradley EB3321
R22	10K	1031-E	Allen Bradley EB1031
R23	10K	1031-E	Allen Bradley EB1031
R24	2K, 25K, pot, Var.	9718-1	Kay Electric Co.
R25	100	1011-E	Allen Bradley EB1011
R26	22K	2231-E	Allen Bradley EB2231
R27	56K	5631-E	Allen Bradley EB5631
R28	22K	2231-E	Allen Bradley EB2231
R29	7.5K, 5% tol.	7525-E	Allen Bradley EB7525
R30	3K, 5% tol.	3025-E	Allen Bradley EB3025
R31	220	2211-E	Allen Bradley EB2211
R32	3.9K	3931-E	Allen Bradley EB3931
R33	9.1K, 5% tol.	9135-E	Allen Bradley EB9135
CAPACITORS:			
C1	18μf, 100V, Electrolytic	6355-73	Sprague Type 40D
C2	33μf, 50V, Electrolytic	6355-132	G.E. 76F02LL339
DIODES:			
D1 & D2	1N461, Silicon	6357-57	Texas 1N461
TRANSISTORS:			
Q1 & Q2	2N3568	K-187	Fairchild 2N3568
RESISTORS:			
R1	2K, 500, 250K, 5K, pot, Var.	9717-2	Kay Electric Co.
R2	4.3K, 5% tol.	4325-E	Allen Bradley EB4325
R3	680K	6841-E	Allen Bradley EB6841
R4	3K, 5% tol.	3025-E	Allen Bradley EB3025
R5	3K, 5% tol.	3025-E	Allen Bradley EB3025
R6	1K	1021-E	Allen Bradley EB1021
R7	6.8K	6821-E	Allen Bradley EB6821
R8	25K, 10K, 500K, 100K, pot, Var.	9717-1	Kay Electric Co.
R9	25K, 10K, 500K, 100K, pot, Var.	9717-1	Kay Electric Co.
R10	82K	8231-E	Allen Bradley EB8231
R11 & R12	25K,10K,500K,100K,pot,var.	9717-1	Kay Electric Co.
R13 & R14	39K, 2 watt	3931-H	Allen Bradley HB3931
R15 & R16	25K,10K,500K,100K,pot,var.	9717-1	Kay Electric Co.
R17	82K	8231-E	Allen Bradley EB8231
R18 & R19	25K,10K,500K,100K,pot,var.	9717-1	Kay Electric Co.
R20	6.8K	6821-E	Allen Bradley EB6821

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
R21	2K,500,250K,5K,pot,var.	9717-2	Kay Electric Co.
R22	220K	2241-E	Allen Bradley EB2241
R23 & R24	680	6811-E	Allen Bradley EB6811
R25	12K	1231-E	Allen Bradley EB1231
R26	2K,500,250K,5K,pot,var.	9717-2	Kay Electric Co.
R27	470	4711-E	Allen Bradley EB4711
R28	6.8K	6821-E	Allen Bradley EB6821
R29	330	3311-E	Allen Bradley EB3311
R30	2K,500,250K,5K,pot,var.	9717-2	Kay Electric Co.
R31	1.2K	1221-E	Allen Bradley EB1221
R32	750, 5% tol.	7515-E	Allen Bradley EB7515

PARTS LIST, ALC

Dwg Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
	Entire ALC	9689	
CAPACITORS:			
C1	.02μf, 100V, Mylar-paper	6899-13	Elmenco 1DP-1-203
C2	.01μf, 100V, Mylar-paper	6899-12	Elmenco 1DP-1-103
C3	250pf, 500V, Silver Mica	6359-75	Elmenco DM-15-251
C4 & C5	.02μf, 100V, Mylar-paper	6899-13	Elmenco 1DP-1-203
C6	10μf, 25V, Electrolytic	6355-94	Sprague Type 40D
C7	1μf, 200V, Mylar	6411-21	Electrocube
C8	47μf, 25V, Electrolytic	6355-127	G.E. 76F02KK470
CONNECTORS:			
J1	Connector, UG625/U	6909-81	Dage UG625/U
TRANSISTORS:			
Q1	Transistor, 2N3566	K-159	Fairchild, 2N3566
Q2	Transistor, 2N3645	K-189	Fairchild, 2N3645
Q3 thru Q5	Transistor, 2N3566	K-159	Fairchild, 2N3566
Q6	Transistor, 2N3569	K-179	Fairchild, 2N3569
RESISTORS: (Unless otherwise specified, all components are fixed composition, $\frac{1}{2}$watt, 10% tol.)			
R1	100K	1041-E	Allen Bradley EB1041
R2	1K	1021-E	Allen Bradley EB1021
R3	10K	1031-E	Allen Bradley EB1031
R4	4.7K	4721-E	Allen Bradley EB4721
R5	100K	1041-E	Allen Bradley EB1041
R6	500K pot "A" taper	9122-58	Allen Bradley

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
R7	1.2K	1221-E	Allen Bradley EB1221
R8	10K, 5K, pot, var.	9718-2	Kay Electric Co.
R9	1K	1021-E	Allen Bradley EB1021
R10	5.6K	5621-E	Allen Bradley EB5621
R11 & R12	10K	1031-E	Allen Bradley EB1031
R13 & R14	33K	3331-E	Allen Bradley EB3331
R15	300, 5% tol.	3015-E	Allen Bradley EB3015
R16	10K, 5K, pot, var.	9718-2	Kay Electric Co.
R17	30K, 5% tol.	3035-E	Allen Bradley EB3035
R18	220	2211-E	Allen Bradley EB2211
R19	510, 5% tol.	5115-E	Allen Bradley EB5115
R20	3.9K	3921-E	Allen Bradley EB3921
R21	3.3K	3321-E	Allen Bradley EB3321
R22	1K	1021-E	Allen Bradley EB1021
R23	2.2K	2221-E	Allen Bradley EB2221
R24	4.7, 5% tol.	4P75-E	Allen Bradley EB4P75
R25	47	4701-E	Allen Bradley EB4701
R26	12	1201-E	Allen Bradley EB1201
R27	3.9K	3921-E	Allen Bradley EB3921
R28	2.7K	2721-E	Allen Bradley EB2721
R29	220	2211-E	Allen Bradley EB2211

SWITCHES:

S1	Switch, Toggle, DPDT	254-A	A-H & H 81027-CE

PARTS LIST, MAIN UNIT

Dwg. Symbol No.	Description	Kay Part No.	Manufacturer & Part No.
CAPACITORS: (All capacitors in $\mu\mu$f, 500Volts unless otherwise indicated.)			
C1 & C2	1000, Ceramic Feedthru	6356-9	Allen Bradley FU6D-102W
C3	100, Silver Mica	6359-46	Elmenco DM-15-101
C4	10$\mu\mu$f, Varicap	8227	Crystalonics VA115
C5	1.2, Ceramic Feedthru	6361-42	Quality Components QC1.2
C6	.24 Ceramic Tubular	6361-48	Quality Components QC.24
C7	20, Silver Mica	6359-57	Elmenco DM-15-200
C8 & C9	50, Ceramic Feedthru	6356-8	Erie X5V2443-50GMV
C10	Factory Selected	------	----------
C11	3.3 Ceramic Tubular	6361-32	Quality Components QC3.3
C12	2.2 Ceramic Tubular	6361-38	Quality Components QC2.2
C13	1.2 Ceramic Tubular	6361-42	Quality Components QC1.2
C14	1000 Ceramic Feedthru	6356-9	Allen Bradley FU6D-102W
C15	50 Ceramic Feedthru	6356-8	Erie X5V2443-50GMV
C16	1000 Ceramic Feedthru	6356-9	Allen Bradley FU6D-102W

C17	10μμf, Varicap	8227	Crystalonics VA115
C18	100, Silver Mica	6359-46	Elmenco DM-15-101
C19	Factory Selected	------	----------
C20	.56 Ceramic Tubular	6361-52	Quality Components QC.56
C21	20, Silver Mica	6359-57	Elmenco DM-15-200
C22	.022μf, 75V, Ceramic Disc	6360-32	Gulton MIN-M-022M
C23	33μf, 50V. Electrolytic	6355-132	G. E. 76F0266339
C24	8500 Ceramic Feedthru	6356-7	Erie X5V2443-8500GMV
C25	.022μf, 75V, Ceramic Disc	6360-32	Gulton MIN-M-022M
C26	4.7μf, 35V, Electrolytic	6355-133	Kemet K4R7J35KS
C27	100, Silver Mica	6359-46	Elmenco DM-15-101
C28	4.7μf, 35V, Electrolytic	6355-133	Kemet K4R7J35KS
C29	100, Silver Mica	6359-46	Elmenco DM-15-101
C30	.022μf, 75V, Ceramic Disc	6360-32	Gulton MIN-M-022M
C31 & C32	8500 Ceramic Feedthru	6356-7	Erie X5V2443-8500GMV
C33	.022μf, 75V, Ceramic Disc	6360-32	Gulton MIN-M-022M
C34	2.2μf, 20V, Electrolytic	6355-134	Kemet K2R2J20KS
C35	100, Silver Mica	6359-46	Elmenco DM-15-101
C36	50, Silver Mica	6359-60	Elmenco DM-15-500
C37 & C38	8500, Ceramic Feedthru	6356-7	Erie X5V2443-8500GMV
C39	.022μf, 75V, Ceramic Disc	6360-32	Gulton MIN-M-022M
C40	Factory Selected	-------	----------
C41	2.2μf, 20V, Electrolytic	6355-134	Kemet K2R2J20KS
C42	33μf, 50V, Electrolytic	6355-132	G. E. 76F02LL339
C43	.2μf, 75V, Ceramic Disc	6360-9	Gulton K8000V, .2K
C44	300, Silver Mica	6359-64	Elmenco DM-15-301
C45	2.2μf, 20V, Electrolytic	6355-134	Kemet K2R2J20KS
C46	8500, Ceramic Feedthru	6356-7	Erie X5V2443-8500GMV
C47	.022μf, 75V, Ceramic Disc	6360-32	Gulton MIN-M-022M
C48	Factory Selected	-------	----------
C49	8500 Ceramic Feedthru	6356-7	Erie X5V2443-8500GMV
C50	.01μf, 75V, Ceramic Disc	6360-31	Gulton K8000V, .01K
C51	50, Silver Mica	6359-60	Elmenco DM-15-500
C52	.01μf, 75V, Ceramic Disc	6360-31	Gulton K8000V, .01K
C53	8500, Ceramic Feedthru	6356-7	Erie X5V2443-8500GMV
C54	.2μf, 75V, Ceramic Disc	6360-9	Gulton K8000V, .2K
C55	3900, 200V, Ceramic Disc	6360-28	Erie Style 4845
C56	1000, Ceramic Feedthru	6356-4	Erie X5V2443-1000GMV
C57 & C58	25μf, 25V, Electrolytic	6355-78	Sprague Type 40D
C59	80μf, 100μf, 300μf, 150V Electrolytic	63559-69	Mallory FP312.6
C60	1500μf, 50V, Electrolytic	6355-115	Mallory WP068
C61 & C62	500 Ceramic Feedthru	6356-6	Erie X5V2443-500GMV
C63	22μf, 35V, Electrolytic	6355-135	Texas Type SCM
C64	2μf, 200V, Mylar	6411-22	Electro Cube
C65	.22μf, 50V, Mylar	6411-1	Goodall 601PE446
C66	.02μf, 400V, Mylar-paper	6899-9	Elmenco 4DP-2-203
C67	.002μf, 600V, Mylar-paper	6899-4	Elmenco 6DP-1-202
C68	3.0, Ceramic Tubular	6361-56	Quality Components QC3.0

DIODES:

D1	HD1870, Germanium	6357-88	Hughes HD1870
D2	HPA3039, Pin Diode	6357-108	Hewlett Packard
D3 thru D9	1N82, Silicon Rectifier	6357-34	Sylvania 1N82

FUSE:

F1	Fuse, $\frac{1}{2}$ Amp, S/B	6908-18	Littlefuse 313.500

LAMPS:

I1	Light Indicator, Bayonet #44	249-44	G.E. #44

CONNECTORS:

J1	26-183, 8contacts, female	6909-2	Amphenol #26-183
J2	UG447/U Coax	6909-1	Dage UG447/U
J3	UG625/U Coax	6909-81	Dage UG625/U
J4	UG909/U Coax	6909-96	Dage UG909/U
J5	UG1051/U Coax	6909-28	Dage UG1051/U
J6	UG909/U Coax	6909-96	Dage UG909/U
J7 & J8	UG625/U Coax	6909-81	Dage UG625/U
J9 thru J13	143-018-01, 18 contacts, female	6909-99	Amphenol #143-018-01
J14	UG185/U Coax	6909-77	Dage UG185/U
J15 & J16	UG535/U Coax	6909-80	Dage UG535/U
J17 & J18	UG185/U Coax	6909-77	Dage UG185/U

COILS:

L1	Special, wound on R3, 10K	L1-9851B	Kay Electric Co.
L2	Special, slug-tuned	L2-9851B	Kay Electric Co.
L3	Special, wound on R11, 10K	L3-9851B	Kay Electric Co.
L4	Special, wound on R12, 470Ω	L4-9851B	Kay Electric Co.
L5	Special, wound on R18, 10K	L5-9851B	Kay Electric Co.
L6	Special, slug-tuned	L6-9851B	Kay Electric Co.
L7	Special, slug-tuned	L7-9851B	Kay Electric Co.
L8	Special, fixed	L8-9851B	Kay Electric Co.
L9	Special, fixed	L9-9851B	Kay Electric Co.
L10 & L11	Choke, 1 MH	6394-20	Caddel Burns #659-3
L12	Choke, 50 MH	6394-4	Kay Electric Co.
M1	Meter, 0-200μ amp	8051	Kay Electric Co.
P1	AC line cord and plug	7166-1	Belden #172375
P2 thru P8	Not Used	--------	----------
P9 thru P13	Part of PC Board	--------	----------
P14 thru P18	UG88/U Coax	6909-76	Dage UG88/U

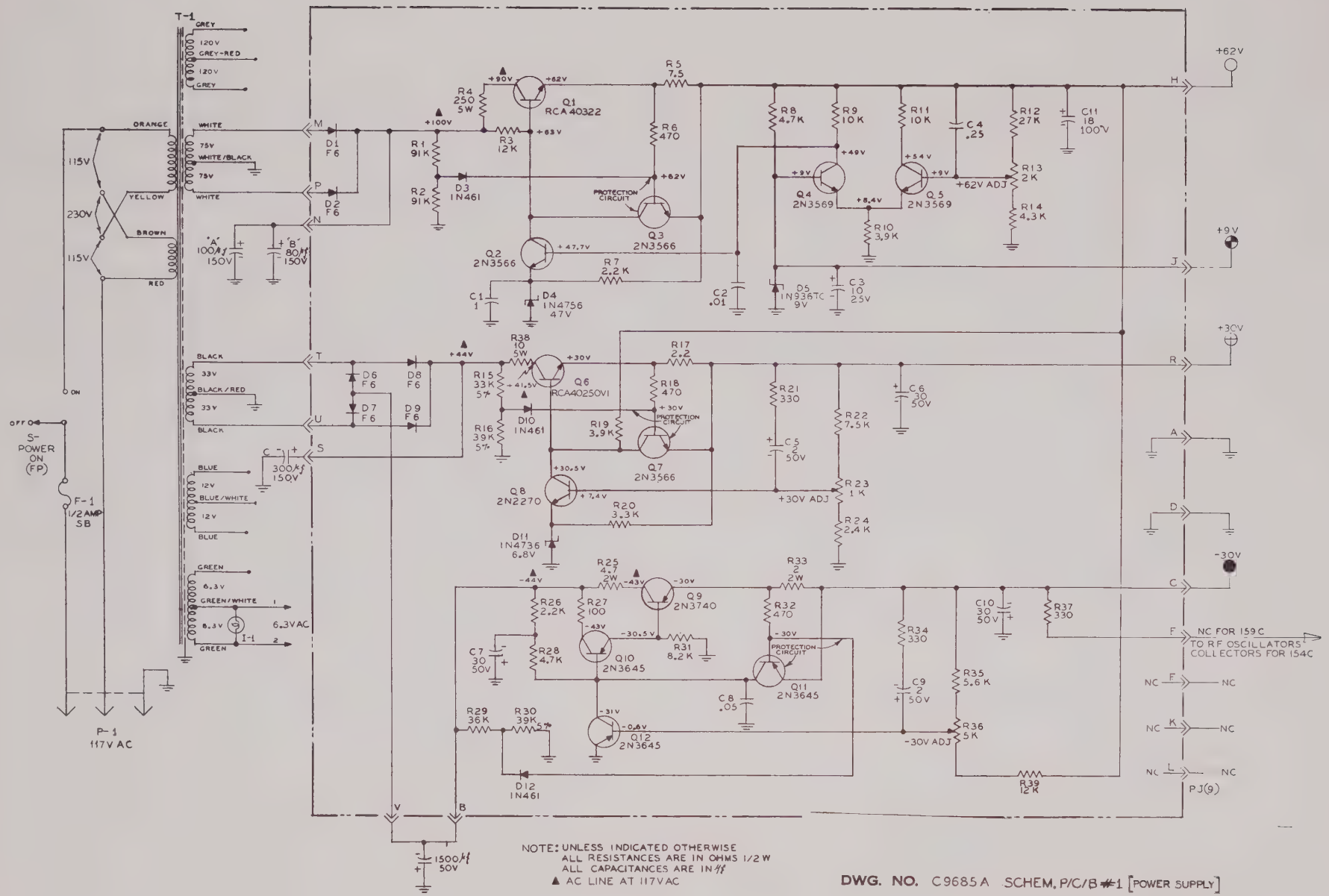
TRANSISTORS

Q1 & Q2	Transistor, 2N1141	K-127	Motorola 2N1141
Q3, Q4, & Q5	Transistor, 40235	K-193	RCA 40235
Q6	Transistor, MM1941	K-157	Motorola MM1941
Q7	Transistor, 2N3553	K-164	RCA 2N3553
Q8	Transistor, MM1941	K-157	Motorola MM1941

RESISTORS: (Unless indicated otherwise, all resistances are in ohms, $\frac{1}{4}$ watt, and 10% tol.)

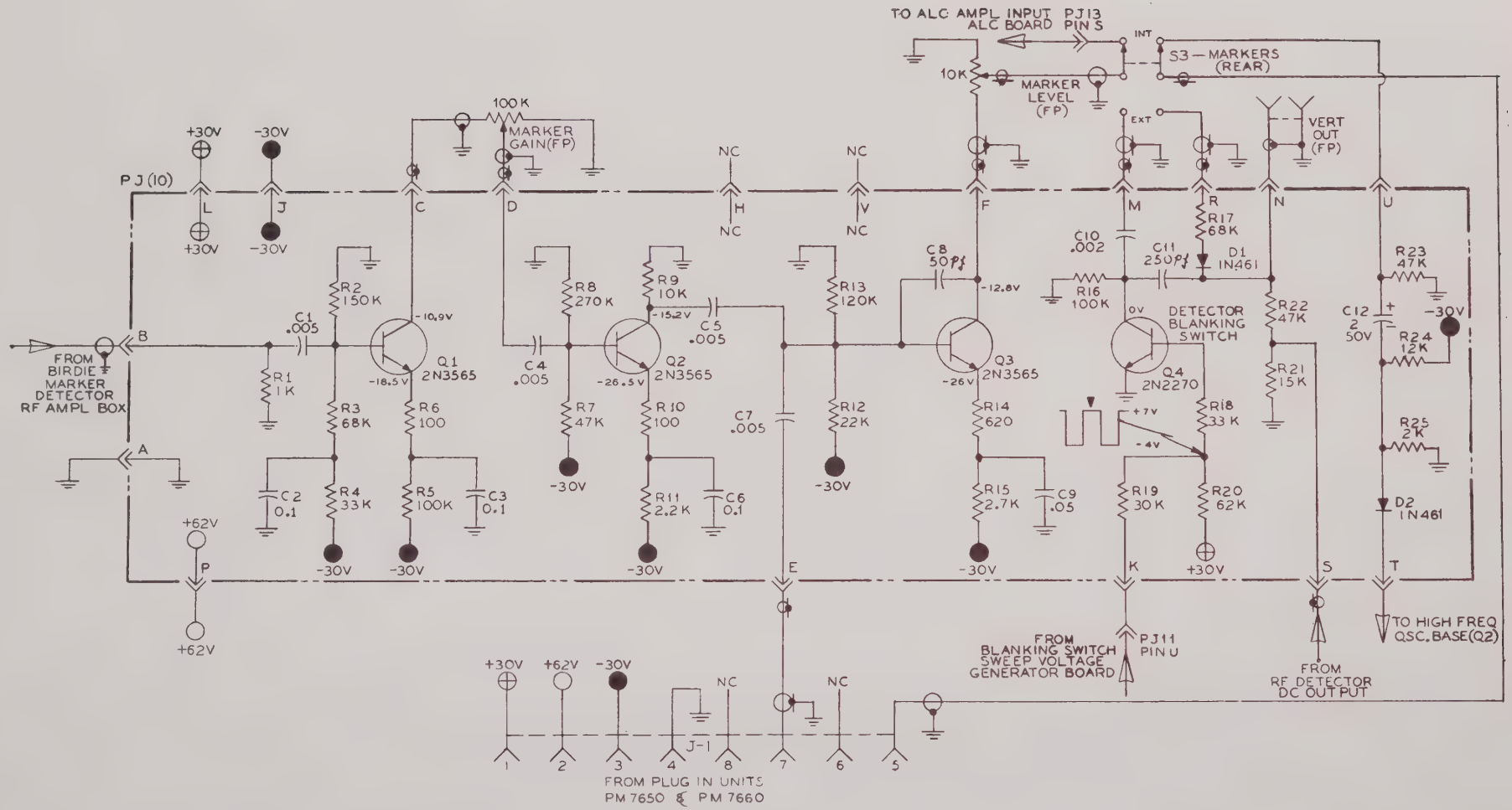
R1	1K, $\frac{1}{2}$ watt	1021-E	Allen Bradley EB1021
R2	4.7K, $\frac{1}{2}$ watt	4721-E	Allen Bradley EB4721
R3	See Coil L1	-------	----------
R4	330	3311-C	Allen Bradley CB3311
R5	220	2211-C	Allen Bradley CB2211
R6	470	4711-C	Allen Bradley CB4711
R7 & R8	4.7K	4721-C	Allen Bradley CB4721
R9	680	6811-C	Allen Bradley CB6811
R10	Factory Selected	-------	----------
R11	See Coil L3	-------	----------
R12	470	4711-C	Allen Bradley CB4711
R13	10K	1031-C	Allen Bradley CB1031
R14	1K, $\frac{1}{2}$ watt	1021-E	Allen Bradley EB1021
R15	4.7K, $\frac{1}{2}$ watt	4721-E	Allen Bradley EB4721
R16 & R17	4.7K	4721-C	Allen Bradley CB4721
R18	See Coil L5	-------	----------
R19	330	3311-C	Allen Bradley CB3311
R20	220	2211-C	Allen Bradley CB2211
R21	15K	1531-C	Allen Bradley CB1531
R22	3.3K	3331-C	Allen Bradley CB3331
R23	2.7, $\frac{1}{2}$ watt, 5% tol.	2P75-E	Allen Bradley EB2P75
R24	10, $\frac{1}{2}$ watt	1001-E	Allen Bradley EB1001
R25	220	2211-C	Allen Bradley CB2211
R26	39	3901-C	Allen Bradley CB3901
R27	8.2K	8221-C	Allen Bradley CB8221
R28	15K	1531-C	Allen Bradley CB1531
R29	3.3K	3331-C	Allen Bradley CB3331
R30	10, $\frac{1}{2}$ watt	1001-E	Allen Bradley EB1001
R31	220	2211-C	Allen Bradley CB2211
R32	Factory Selected	-------	----------
R33	6.8K	6821-C	Allen Bradley CB6821
R34	3.9K	3921-C	Allen Bradley CB3921
R35	5.6K	5621-C	Allen Bradley CB5621
R36	10, $\frac{1}{2}$ watt	1001-E	Allen Bradley EB1001
R37	470	4711-C	Allen Bradley CB4711
R38	68	6801-C	Allen Bradley CB6801
R39	1.2K	1221-C	Allen Bradley CB1221
R40	2.7K	2721-C	Allen Bradley CB2721
R41	8.2K	8221-C	Allen Bradley CB8221
R42 & R43	680	6811-C	Allen Bradley CB6811
R44	Factory Selected	-------	----------

R45	47	4701-C	Allen Bradley CB4701
R46	300, $\frac{1}{2}$ watt, 5% tol.	3015-E	Allen Bradley EB3015
R47	2.2K	2221-C	Allen Bradley CB2221
R48	1.5K	1521-C	Allen Bradley CB1521
R49	470	4711-C	Allen Bradley CB4711
R50	10, $\frac{1}{2}$ watt	1001-E	Allen Bradley EB1001
R51	47, $\frac{1}{2}$ watt	4701-E	Allen Bradley EB4701
R52	180, 2 watt	1811-H	Allen Bradley HB1811
R53	220	2211-C	Allen Bradley CB2211
R54	50	6558-273	Mepco Tupe C10
R55	2.7, $\frac{1}{2}$ watt, 5% tol.	2P75-E	Allen Bradley EB2P75
R56	220	2211-C	Allen Bradley CB2211
R57	6.8K	6821-C	Allen Bradley CB6821
R58	330	3311-C	Allen Bradley CB3311
R59	2.2K	2221-C	Allen Bradley CB2221
R60	4.7K	4721-C	Allen Bradley CB4721
R61	1K, $\frac{1}{2}$ watt	1021-E	Allen Bradley EB1021
R62	220	2211-C	Allen Bradley CB2211
R63	68	6801-C	Allen Bradley CB6801
R64	10, $\frac{1}{2}$ watt	1001-E	Allen Bradley EB1001
R65	50	6558-273	Mepco Type C10
R66	200, 2 watt, pot, Var.	9122-11	Allen Bradley
R67 & R68	100K/10K Dual, pot, Var.	7977	Allen Bradley 89445
R69	560, $\frac{1}{2}$ watt	5611-E	Allen Bradley EB5611
R70	500, 2 watt, pot, Var.	9122-16	Allen Bradley
R71	1K, Prec., pot, Var.	8225	Spectrol Type 530-1K
R72	2K, 2 watt, pot, Var.	9122-22	Allen Bradley
R73	5K, 2 watt, pot, Var.	9122-28	Allen Bradley
R74	10K, 2 watt, pot, Var.	9122-31	Allen Bradley
R75 & R76	1 Meg, 2 watt, pot, Var.	9122-63	Allen Bradley
S1	Switch, Rotary, 3 wafer, 5 pos.	8112C	Kay Electric Co.
S2	Switch, Rotary, 2 wafer, 5 pos.	9763	Kay Electric Co.
S3 & S4	Switch, Toggle, DPDT	254-A	A - H & H 81027-CE
S5	Switch, Toggle, SPST	255-A	A - H & H 21350-CF
S6	Switch, Toggle, DPDT	254-A	A - H & H 81027-CE
S7	Switch, Toggle, SPST	255-A	A - H & H 21350-CF
T1	Transformer, Power	7679	Kay Electric Co.
	Atten. Assy. (wired)	8275	Kay Electric Co.
	Digidial	7726	Helipot Mod. 202



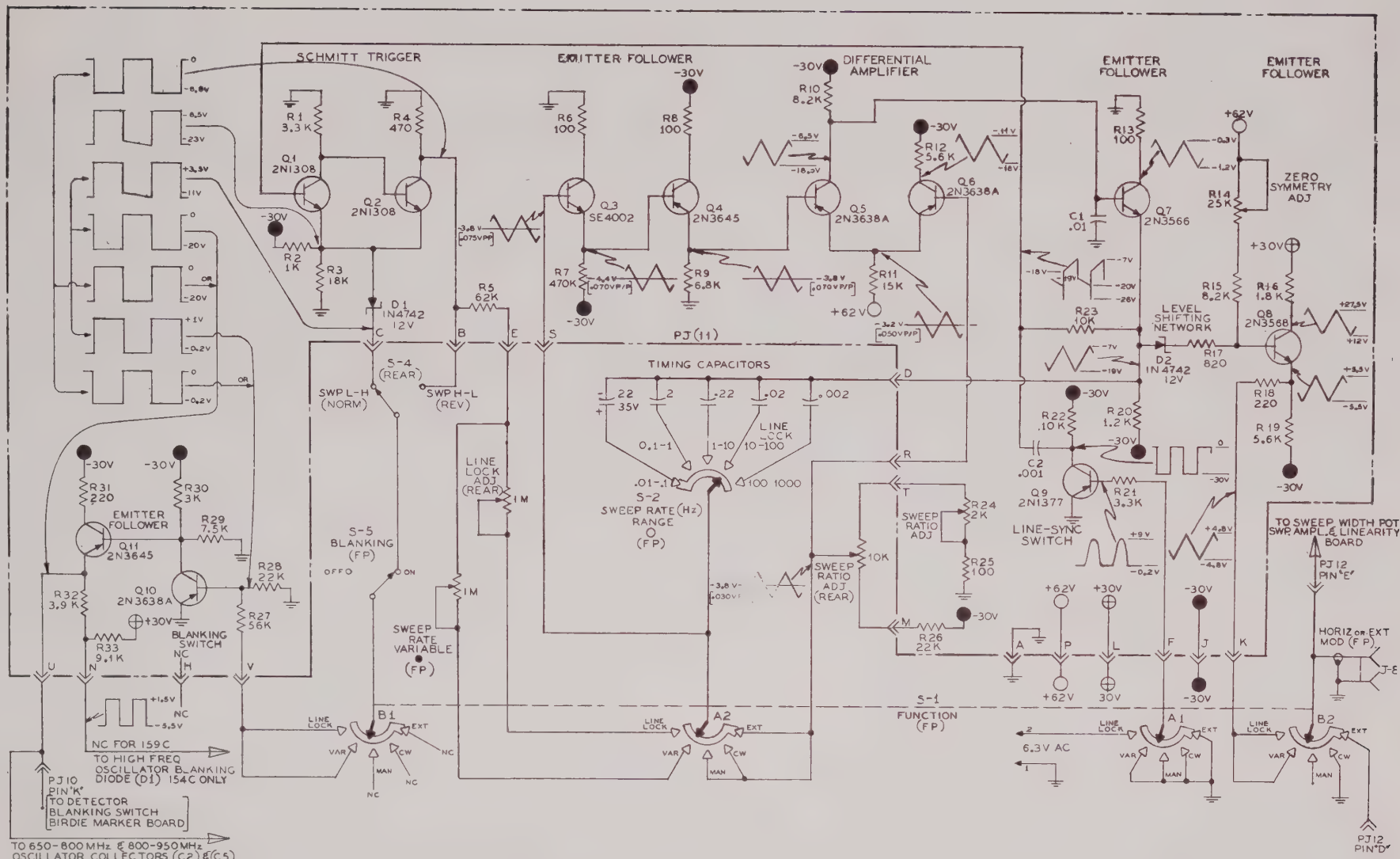
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2 W
ALL CAPACITANCES ARE IN µf
▲ AC LINE AT 117VAC

DWG. NO. C9685A SCHEM. P/C/B #1 [POWER SUPPLY]



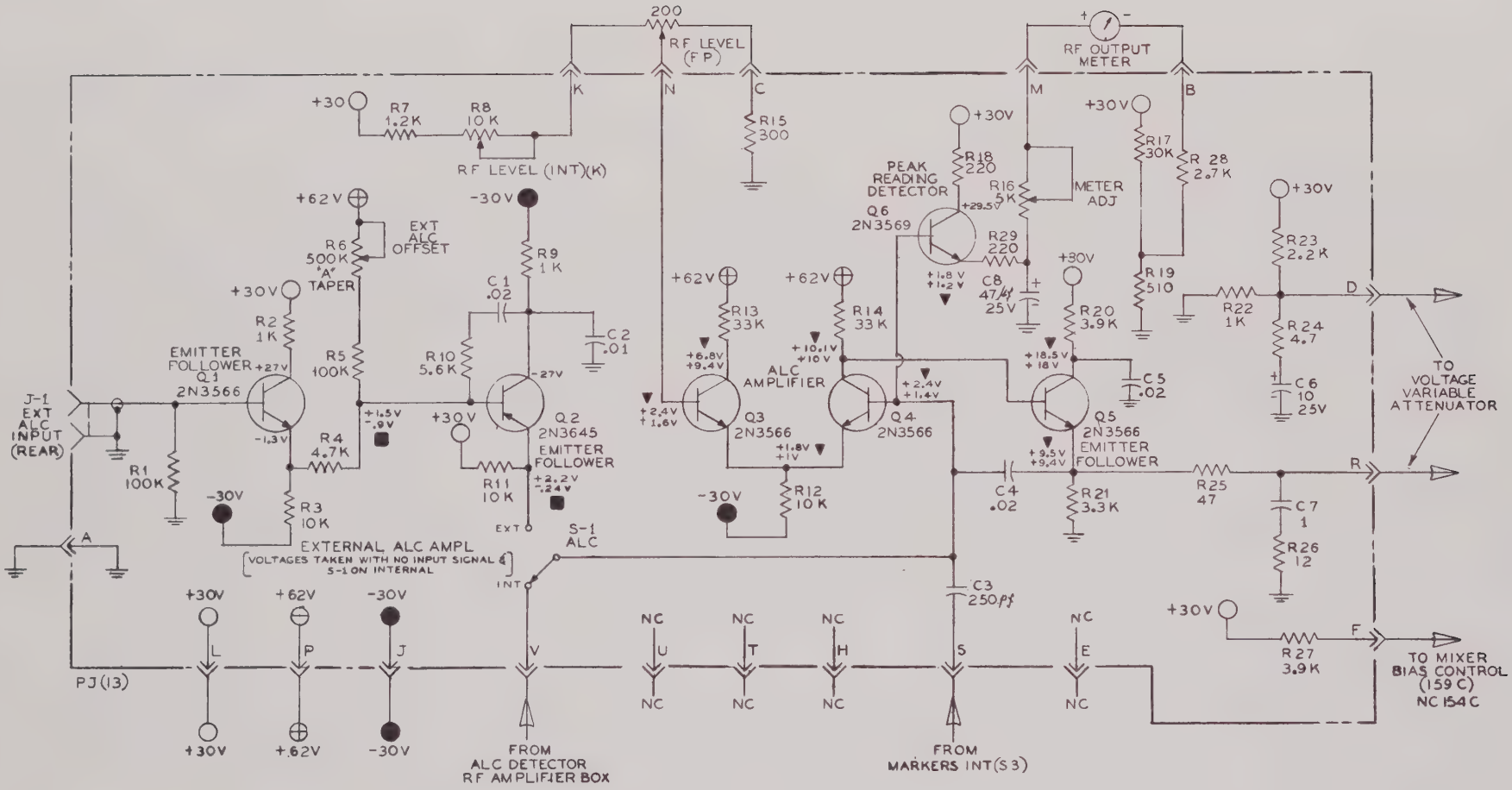
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2W
ALL CAPACITANCES ARE IN μf
(FP) INDICATES FRONT PANEL
▼ MEASUREMENTS DURING BLANKING ON

DWG. NO. B 9686 A SCHEM P/C/B #2 [BIRDIE MARKER AMPLIFIER]



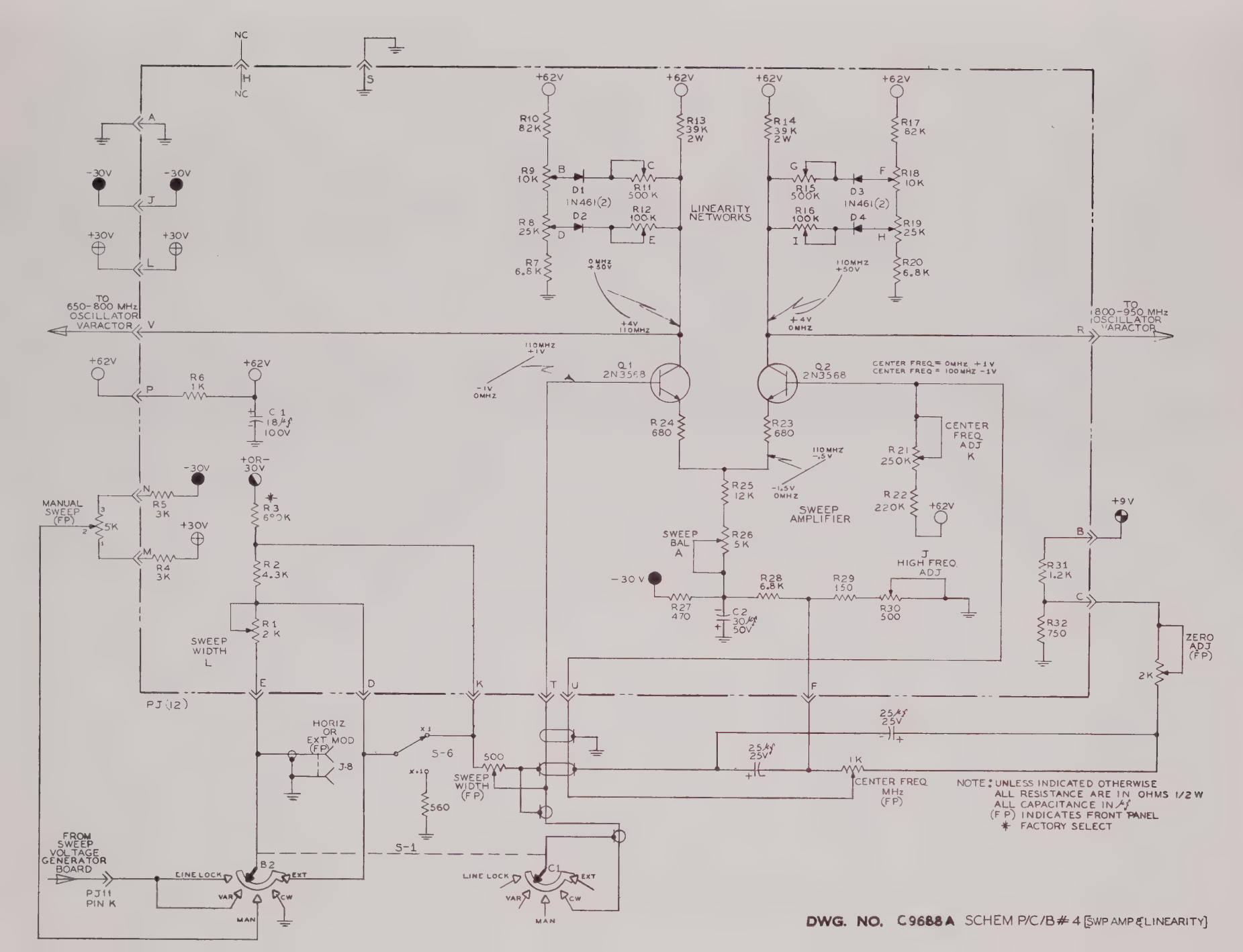
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHM 1/2 W
ALL CAPACITANCE ARE μF
(FP) INDICATES FRONT PANEL

DWG. NO. C 9687B SCHEM P/C/B#3 [SWP VOLTAGE GENERATOR]



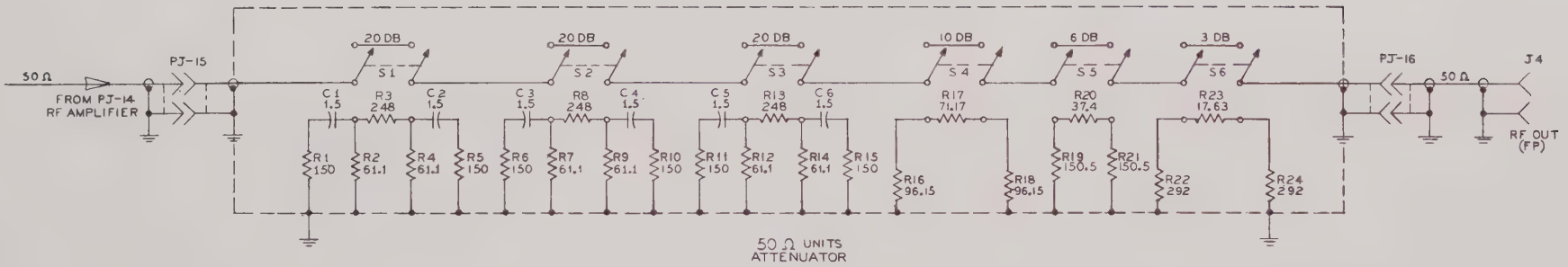
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/2W
ALL CAPACITANCE IN µf
■ R6 MINIMUM (UPPER)
MAXIMUM (LOWER)
▼ RF LEVEL (FP)
MAXIMUM (UPPER)
-3DB (LOWER)
CONDITIONS OF MEASUREMENT
ALC (INT); CENTER FREQ. (50MHZ)
FUNCTION (CW)

DWG. NO. B9689A SCHEMATIC P/C/B 5 — ALC

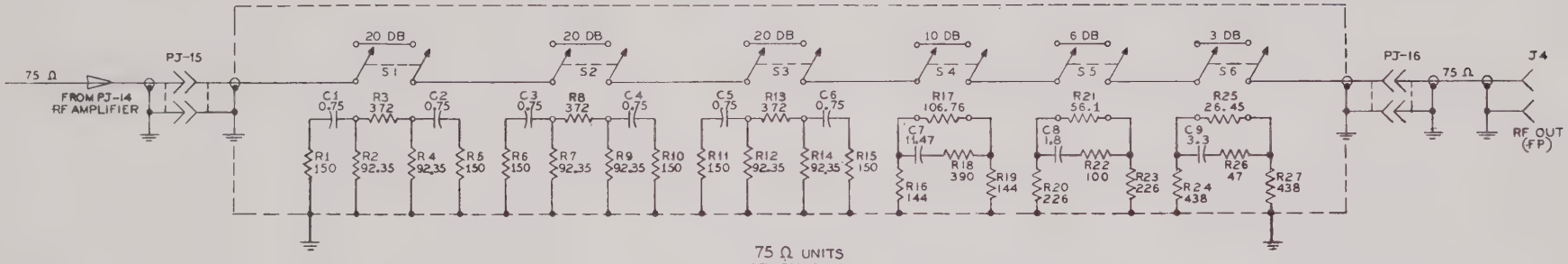


NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCE ARE IN OHMS 1/2 W
ALL CAPACITANCE IN µf
(F P) INDICATES FRONT PANEL
* FACTORY SELECT

DWG. NO. C9688A SCHEM P/C/B # 4 [SWP AMP & LINEARITY]



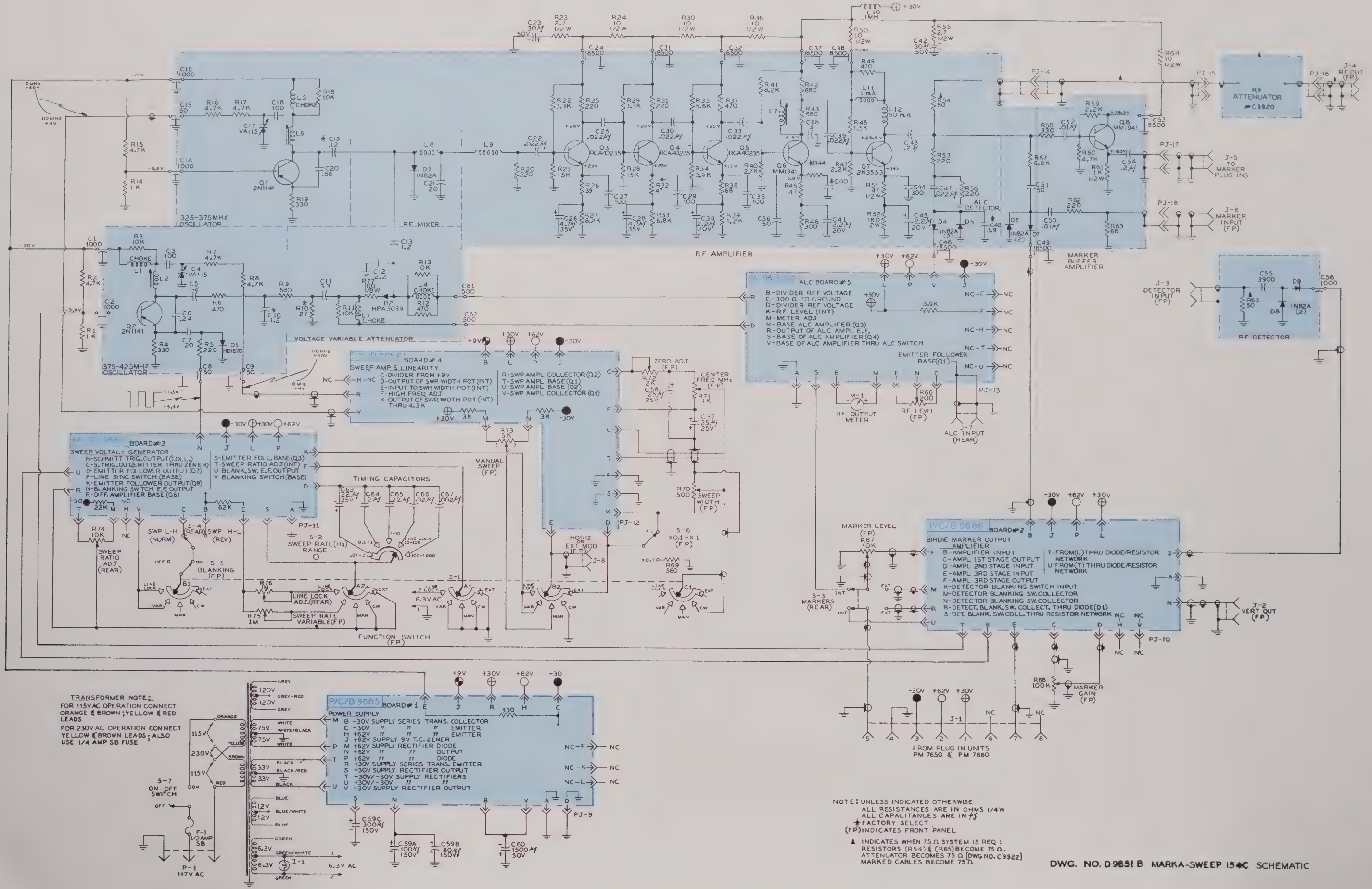
50 Ω UNITS
ATTENUATOR



75 Ω UNITS
ATTENUATOR

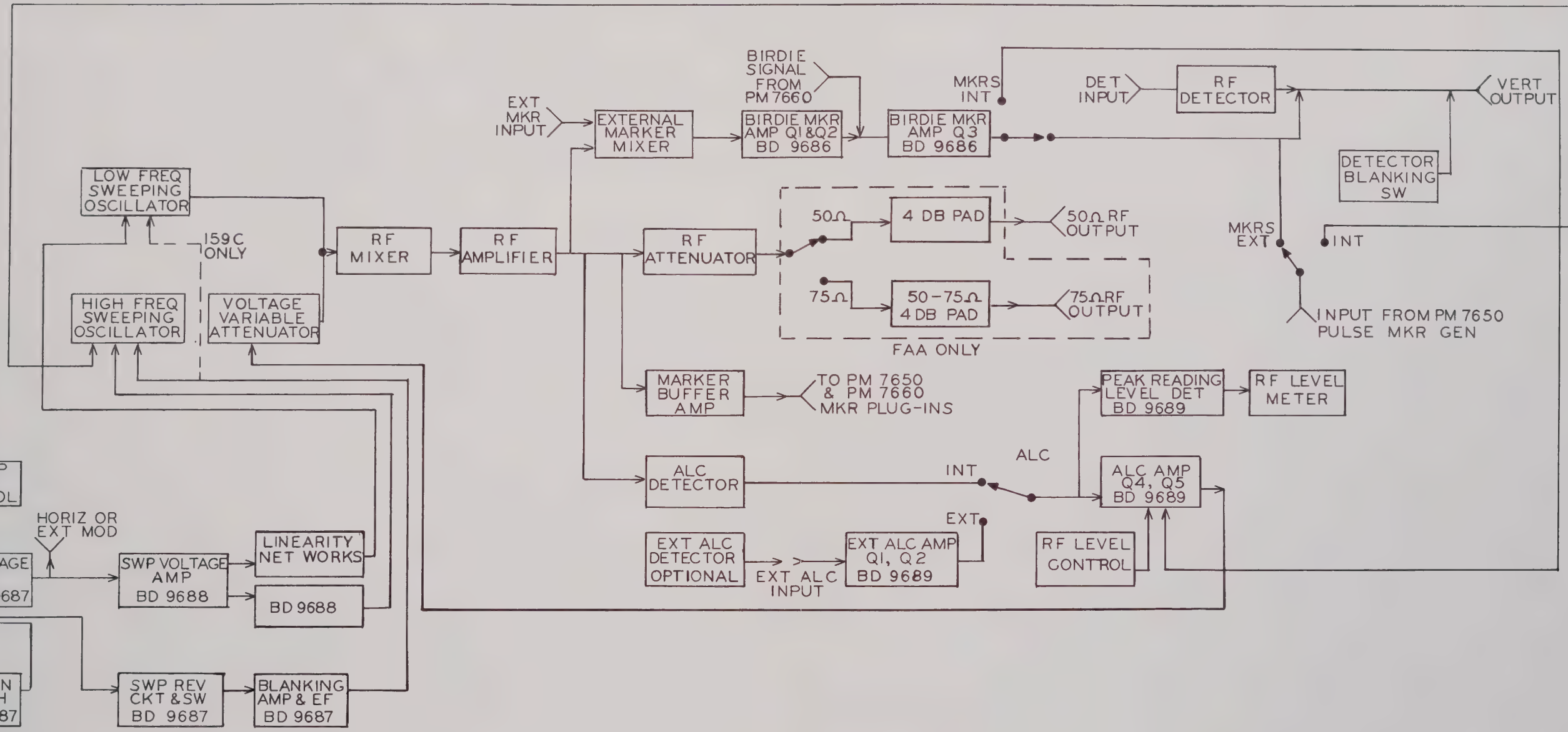
NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS-1/4 W
ALL CAPACITANCES ARE IN pf

DWG. NO. C9920A SCHEMATIC, ATTENUATOR [50Ω/75Ω]



NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS 1/4W
ALL CAPACITANCES ARE IN μf
* FACTORY SELECT
(FP) INDICATES FRONT PANEL
▲ INDICATES WHEN 75Ω SYSTEM IS REQ: RESISTORS (R54) & (R65) BECOME 75Ω. ATTENUATOR BECOMES 75Ω [DWG NO. C9922] MARKED CABLES BECOME 75Ω

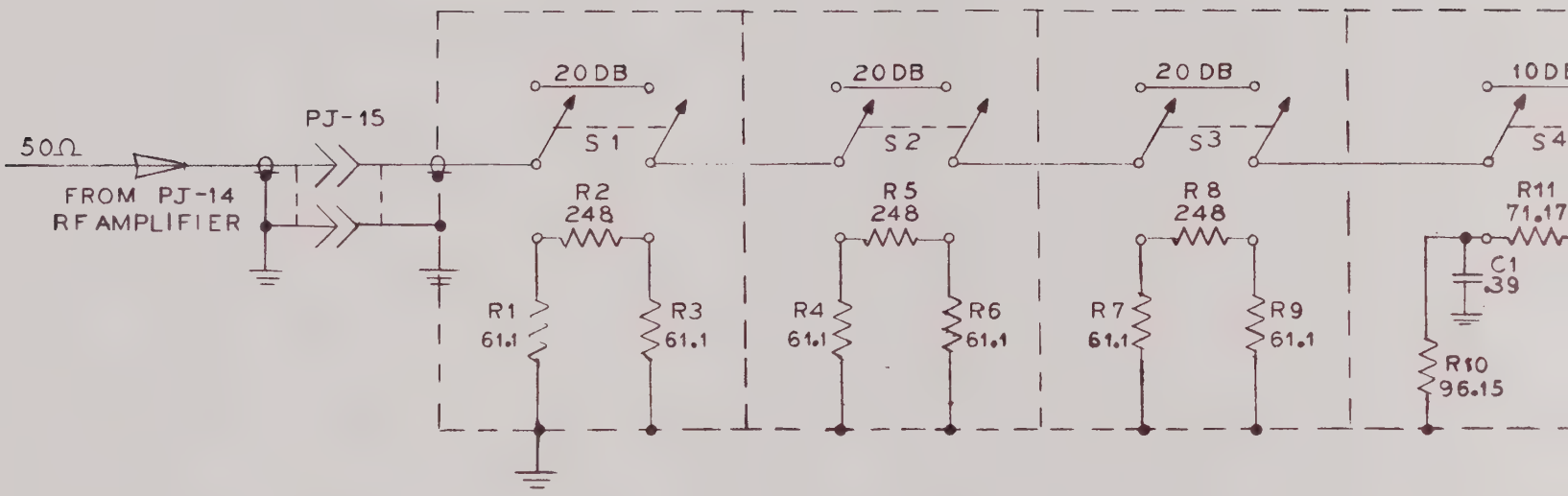
DWG. NO. D9851 B MARKA-SWEEP 154C SCHEMATIC



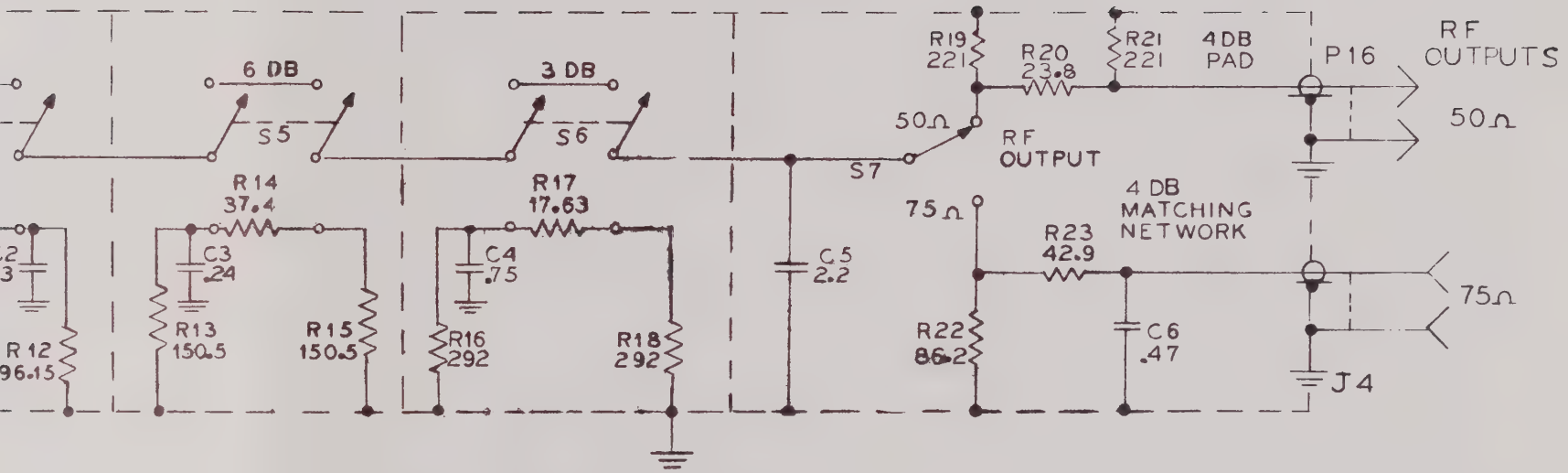
BLOCK DIAGRAM

154C/159C & 154C FAA

NOTE:
MAIN SIGNALS ENTER ON LEFT, LEAVE ON RIGHT.
AUXILARY OR CONTROL SIGNALS ENTER & LEAVE ON TOP & BOTTOM.



NOTE: UNLESS INDICATED OTHERWISE
ALL RESISTANCES ARE IN OHMS-1/4W
ALL CAPACITANCES ARE IN μf



SCHEMATIC, ATTENUATOR [50Ω] MARKA-SWEEP 154CFA

ADDENDUM

FAA-E-2280

This addendum applies to all special units provided for the Federal Avaition Agency as per FAA Specification FAA-E-2280.

This Maintenance Manual should be changed in the following manner:

SECTION I

Para. 1.2.

Board 9687:

Delete references to 0.1 and 1000 Hz and add 5:65 Hz.
Change "375-430 MHz oscillator" to 375-425 MHz oscillator."

Board 9688:

The RF oscillators sweep 50 MHz rather than 55 MHz, thus the swept output is 100 MHz. The frequency of the high-frequency oscillator is 375-425 MHz and the low frequency oscillator 325-375 MHz.

SECTION II

2.3 ALIGNMENT PROCEDURE

2.3B - delete all references to sweep rates and perform alignment with unit in Var. Swp.

PARTS LIST

Whenever replacement plug-in boards are ordered as complete assemblies, the following part numbers will be applicable:

POWER SUPPLY, BOARD #1 - C 9685A-FA
BIRDIE MARKER AMPLIFIER, BOARD #2 - B 9688A-FA
SWEEP VOLTAGE GENERATOR, BOARD #3 - C 9687B-FA
SWEEP AMPLIFIER & LINEARITY, BOARD #4 - C 9688A-FA
ALC, BOARD #5 - B 9689A-FA
ATTENUATOR, COMPLETE - C 10140-FA

The following parts list contains changes made to the standard Marka-Sweep 154-C units to enable them to comply with FAA Specification FAA-E-2280.

CHANGES

Dwg. Symbol No.	From	To	Kay Part No.
Board No. 3			
C-2	.001μf, 600V	.005μf,100V, Mylar Paper	6899-14
R-5	62K, 5%	43K, 5%	4335-E
B 9689A			
R-17	----------	43K, 5%	4335-E
R-29	----------	120	1211-E
MAIN CHASSIS ASSEMBLY			
C-27	100, Silver Mica	62, Silver Mica	6359-77
C-29	100, Silver Mica	50, Silver Mica	6359-60
C-35	100, Silver Mica	50, Silver Mica	6359-60
C-36	50, Silver Mica	82, Silver Mica	6359-72
C-43	.2μf, 75V, Ceramic Disc	.039μf,75V,Ceramic Disc	6360-30
C-45	2.2μf, 20V, Kemet	2.2μf, 20V, Electrolytic	6355-134
C-47	.022μf, 75V, Ceramic Disc	5600, 75V, Ceramic Disc	6360-35
C-48	FACTORY SELECTED	1.0, Ceramic Tubular	6361-47
C-55	3900, 200V, Ceramic Disc	.022μf, 75V, Ceramic Disc	6360-32
C-56	1000, Ceramic Feedthru	8500 Ceramic Feedthru	6356-7
C-63	22μf, 35V, Electrolytic	.05μf, 100V, Mylar Paper	6899-1
C-64	2μf, 200V, Mylar	.022μf, 75V, Ceramic Disc	6360-32
C-65	.22μf, 50V, Mylar	.056μf, 35V, Electrolytic	6355-136
C-66	Standard	NOT USED	--------
C-67	Standard	NOT USED	--------
D-10	NOT USED	1N82A	6357-34
D-11	NOT USED	1N82A	6357-34
J-3	UG-625/U, Coax.	REN0740, Coax. BSM	6909-101
J-19	NOT USED	UG-625B/U, Coax.	6909-100
Q-7	Transistor, 2N3553	2N-3866	K-170
R-32	FACTORY SELECTED	47	4701-C
R-47			
R-48	1.5K	2.7K	2725-C
R-49	470	1.5K	1521-C
R-51	47, ½W	30, ½W, 5%	3005-E
R-52	180, ½W	56, ½W, 5%	5606-E
R-53	220	560	5611-C

Dwg. Symbol No.	From	To	Kay Part No.
R-57	6.8K	5.6K	5621-C
R-58	330	1K	1021-C
R-65	50	52.8, 1%	6558-142
R-77	NOT USED	NOT USED	---------
R-78	NOT USED	79.2, 1%	6558-274
R-79	NOT USED	4.7K	4721-C
R-80	NOT USED	390	3911-C
S-2	Rotary Switch	NOT USED	---------

ATTENUATOR 10140-FA

Dwg. Symbol No.	Description	Kay Part No.	Mfr. & Part No.
CAPACITORS:			
C-1	.39μμf, 500V, Ceramic	6361-58	Quality Component QC .39
C-2	.3μμf, 500V, Ceramic	6361-40	Quality Component QC .3
C-3	.24μμf, 500V, Ceramic	6361-48	Quality Component QC .24
C-4	.75μμf, 500V, Ceramic	6361-37	Quality Component QC .75
C-5	2.2μμf, 500V, Ceramic	6361-38	Quality Component QC 2.2
C-6	.47μμf, 500V, Ceramic	6361-43	Quality Component QC .47
CONNECTORS:			
J-4	UG-625/U, Coax	6909-81	Dage UG-625/U
J-15	UG-535/U, Coax	6909-80	Dage UG-535/U
PLUGS:			
P-16	Plug, REN0740, Type BSM	6909-101	Automatic Metal REN0740
RESISTORS: (Unless otherwise indicated, all resistors are in ohms, $\frac{1}{4}$ watt, 1% tolerance.)			
R-1	61.1	6558-97	Mepco Type C10-61.1
R2	248	6558-98	Mepco Type C10-248
R3 & R4	61.1	6558-97	Mepco Type C10-61.1
R5	248	6558-98	Mepco Type C10-248
R6 & R7	61.1	6558-97	Mepco Type C10-61.1
R8	248	6558-98	Mepco Type C10-248
R9	61.1	6558-97	Mepco Type C10-61.1
R10	96.15	6558-99	Mepco Type C10-96.15
R11	71.17	6558-100	Mepco Type C10-71.17
R12	96.15	6558-99	Mepco Type C10-96.15
R13	150.5	6558.59	Mepco Type C10-150.5
R14	37.4	6558-58	Mepco Type C10-37.4
R15	150.5	6558-59	Mepco Type C10-150.5

Dwg. Symbol No.	Description	Kay Part No.	Mfr. & Part No.
R-16	292	6558-101	Mepco Type C10-292
R-17	17.63	6558-102	Mepco Type C10-17.63
R-18	292	6558-101	Mepco Type C10-292
R-19	221	6558-181	Mepco Type C10-221
R-20	23.8	6558-132	Mepco Type C10-23.8
R-21	221	6558-181	Mepco Type C10-221
R-22	86.2	6558-155	Mepco Type C10-86.2
R-23	42.9	6558-135	Mepco Type C10-42.9

SWITCHES:

S-1 thru S-6	Switch, Toggle, DPDT	254-TM	Kay Electric Co.
S-7	Switch, Toggle, DPDT	254-TXM	Kay Electric Co.